

# The National Mango Board and the United States Mango Market

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The National Mango Board (NMB) is a national agriculture promotion and research organization authorized by the United States Congress, approved and overseen by the U.S. Department of Agriculture (USDA), and supported by the fresh whole mango industry. The NMB is entirely funded by assessments from domestic and imported mangos and does not include any taxpayer dollars or government funding. The NMB's mission is to increase the consumption of fresh mango in the U.S. by inspiring consumers and educating them about the culture, flavor, and nutrition of mangos, while bringing the industry together. This mission is accomplished through four main programs: marketing, communications, research, and industry relations. Marketing and communications programs target consumers plus retailers, foodservice, nutritionists, and other key audiences with information about selection, ripening, cutting, varieties, nutrition, and great recipes. Research and industry relations programs help the entire mango supply chain deliver a quality product to the U.S. consumer through research and extension meetings to educate and inform growers, shippers, packers, importers, retailers and others. The research program also investigates the phytonutrient properties of mango and conducts studies on the potential health benefits of mango.

From 2005 to 2020, the mango import volume into the U.S. increased by 110% (from 260,842 MT to 549,211 MT) and per capita mango availability has increased by 193%, from 1.88 pounds to 3.63 pounds per person. Mexico, Peru, Ecuador, Brazil, Guatemala and Haiti are the countries with the highest volume. For retail sales per store per week, the mango category has increased from \$109 to \$262 and the volume of whole mango has increased from 132 to 261 units. From March 2013 to December 2020, NMB promotion programs generated a return on investment of 11.53 to 1.

The National Mango Board (NMB), based in the United States, is a promotion and research organization that was established in 2005 at the request of the mango industry. In 2001, U.S. mango importers, with the support of the Fresh Produce Association of the Americas, submitted a proposal to the U.S. Department of Agriculture (USDA) to request the formation of a national promotion, research, and information order specific for fresh mango, pursuant to the Commodity Promotion, Research, and Information Act of 1996 (AMS, 1996). This proposal was made to (1) develop and finance an effective and coordinated program of research, promotion and industry and consumer information regarding mango; (2) strengthen the position of the mango industry in U.S. markets; and (3) maintain, develop, and expand domestic markets for mangos.

In 2004, USDA finalized the review process of all information submitted including the mango industry's proposal, public rule making comments, a referendum conducted on mango first handlers and importers and concluded that a Mango Order should be established (CFR, 2004). The NMB was formally established the following year when USDA appointed the first group of board members, and the board met to create and approve the organization's bylaws and the initial mango promotion and research programs were set up.

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The Mango Order authorizes the collection of assessments from first handlers and importers that market 500,000 or more pounds of mangos per year to operate and cover the expenses of the NMB promotion and research programs. In 2020, the fresh whole mango assessment rate was three-quarters of a cent per pound of mango (\$0.0075/lb.) which generated approximately \$9 million in assessments (NMB, 2021).

Another requirement of the Mango Order is that a continuance referendum be conducted every five years to determine whether a majority of mango first handlers and importers are in favor of continuing the promotion and research programs. Failing to do so allows USDA to terminate the Mango Order. Mango continuance referendums have been conducted successfully in 2010, 2015, and 2020.

## National Mango Board (NMB) Structure, Priorities, and Programs

### NMB Structure

The NMB has eighteen (18) board seats that are assigned to mango industry members nominated by their peers and reviewed and appointed by the U.S. Secretary of Agriculture. The board seats are specifically defined in the Mango Order and include: ten (10) importers, eight (8) foreign producers, two (2) domestic producers, and one (1) first handler. Each board member serves a three-year term, with the possibility of serving a second consecutive term.

Board members are responsible for reviewing and approving NMB programs and budgets (which was set at approximately \$10 million at the start of 2020) and providing direction and guidance to NMB staff on the strategic direction and specific activities of the organization. NMB staff is responsible for executing the board's direction and managing the promotion and research programs. Each NMB member also serves on at least one of three committees: Marketing & Communications; Research & Industry Relations; and the Executive Committee.

### NMB Priorities

The NMB's short- and long-term priorities are guided by a strategic plan that is developed by NMB board members, staff, and partners. It is reviewed and updated every three years. The

current NMB Strategic Plan runs through the end of 2023 and includes the organization's mission, vision, objectives, and key strategic pillars. The NMB mission is "To increase the consumption of mango in the U.S. by inspiring consumers and educating them about the culture, flavor, and nutrition of mangos, while bringing the industry together". The vision is "For mangos to move from being an exotic fruit to a daily necessity in every U.S. household." The main strategic objective is for mango to "move toward becoming at least a top 15 whole fruit by value in the U.S. market by 2025." The NMB Strategic Plan also includes the following Five Key Strategic Pillars to achieve its mission, vision, and objectives:

1. **Deliver High-Quality & Flavorful Mangos.** Deliver consistently high-quality fresh products and improve the flavor profiles delivered to the consumer across the varieties of mangos.
2. **Market Positioning.** Continuously improve market positioning and adoption across all relevant consumer audiences for fresh mango, as well as products with mango ingredients
3. **Consumer Education.** Understand and analyze key consumption barriers and use strong research-based strategies to enhance consumer familiarity, understanding, and sentiment towards the purchase of fresh mango.
4. **Market Penetration.** Drive mango market penetration in retail, foodservice, and industrial uses of fresh mango products.
5. **Industry Service and Engagement.** Improve value-added and industry information for fresh mango to support greater efficiency. Build support for the program and participation by the assessment payers in the fresh sectors and throughout the supply chain.

Each of the five strategic pillars includes outlined plans to achieve specific objectives that are supported annually with business plans and budgets that contain further details and key performance indicators. The NMB Strategic Plan is the foundation for the NMB Programs which are responsible for fulfilling the mission, vision, objectives, and strategic priorities of the organization.

### **NMB Programs**

The NMB's overall mission is to increase the consumption of fresh mango in the U.S. by first, inspiring and educating consumers about the culture, flavor, and nutrition of mangos and second, bringing the industry together through programs in: Marketing, Communications, Research, Industry Relations, and Operations. Marketing and Communications programs target consumers, retailers, foodservice, nutritionists, and other key audiences with information on mango selection, ripening, cutting, varieties, and nutrition, plus food and beverage recipes. Research and Industry Relations programs focus on improving production and postharvest practices to deliver consistent high-quality mango to U.S. consumers and sharing this information throughout the supply chain through meetings and online webinars. Research programs also investigate the phytonutrient properties of mango and conduct studies on the potential health benefits of mango.

### **Marketing & Communications Programs**

Consumer Marketing and public relation campaigns are designed to increase mango consumption and awareness amongst

U.S. consumers as outlined in the NMB Strategic Plan. The program uses education primarily focused on nutrition, how to select and cut mangos, and prepare mango inspired recipes. In addition, consumer research identifies and generates key messaging, which is strategically applied to a combined omnichannel and multimedia approach including print, broadcast, and social media, influencers, and digital platforms.

The Retail Marketing and Promotion program increases mango awareness and overall purchases throughout the country. NMB works directly with retail and wholesale partners and supports whole and fresh-cut mango growth initiatives that include: training on mango quality and handling practices; establishing year-round mango category programs; improved merchandising and in-store display strategies; retail promotions; fostering ripe-and-ready-to-eat mango ripening programs; analyzing and sharing mango retail category data and consumer insights; motivating sustainability efforts; and highlighting mango nutrition messaging. There is a team of regional retail merchandisers who work directly with retailers throughout the U.S. and represent the NMB at industry tradeshows and events.

The Foodservice program positions mango as an on-trend ingredient and expands menu penetration by increasing awareness throughout the foodservice supply chain using education, training, and outreach to chefs, culinary influencers, and decision makers. The program also supports foodservice mango promotions and marketing campaigns that enhance consumer awareness. The NMB has worked with the Culinary Institute of America to establish an approved curriculum of 8.5 continuing education hours focused specifically on the use of mango in foodservice operations. The Foodservice program also works to expand the use and availability of fresh-cut mango and improve processing and handling practices.

The Communications program develops and manages year-round public relations communication and advertising campaigns with produce industry media and trade publications and provides communication support to all NMB programs. It also keeps the mango industry informed of NMB projects, activities, and available resources through the organization's website, newsletters, annual reports, social media, etc. The program maintains a crisis communication plan and collaborates with partners to provide crisis response training to key NMB staff and board members, and monitors and tracks industry issues that can affect the NMB or mango consumption.

### **NMB Research and Industry Relations Programs**

The Research program supports science-based investigation to improve the understanding of mango as a fruit and as a commodity. Research studies funded with universities and institutions around the world focus on the nutritional and health benefits of mango. The program supports the mango supply chain by supporting studies that improve production and postharvest best management practices that deliver more consistent and higher quality mangoes to consumers.

Completed NMB funded research studies can be found at <[www.mango.org/research-studies](http://www.mango.org/research-studies)>. They are presented to the industry through online webinars, social media, videos, and traditional media articles. Resources developed from research studies are included in existing resources, so the entire mango supply chain has access to the latest best practices. The NMB also supports research presentations at industry meetings, conferences, and symposia.

The Industry Relations program works with mango and produce industry organizations in the United States and countries

that supply the U.S. market with mangoes. The program also engages directly with stakeholders in the mango supply chain (growers, packers, shippers, importers, handlers, processors, retailers, manufacturers, and service providers). This outreach is an effective method of ensuring that NMB resources, research studies and related information reach industry members who can apply it directly to their operations. NMB stakeholders are interested in U.S. mango supply and demand dynamics and market development. NMB outreach efforts play a significant role in bridging the gap between the multiple layers of the supply chain by encouraging and generating communication among industry members.

A key resource by Industry Relations is the Mango Crop Report, which serves as a guide for both mango suppliers and marketers. This weekly report contains information and data on countries that are shipping or are about to start shipping mangos to the US. It compiles information from country mango organizations, industry contacts, econometric models, and USDA reports. The report includes shipping projections, volume shipped, volume that has arrived/is projected to arrive in the U.S., arrival volume comparisons to the prior year, details on varieties shipped from each country, status of mangos sent by ship, pricing information by port, variety, size, and Freight on Board (FOB) price comparisons to the previous year.

### Operations Program

The Operations program ensures the NMB is in compliance with all applicable legislation, regulations, standards, and policies set by USDA, and works closely with USDA on all oversight matters.

The annual NMB nominations process for selecting new board members is handled by the Operations program and involves educating and informing mango industry members of the duties and responsibilities of NMB members. The program organizes and manages all the nomination activities including submitting the information required by USDA for the Secretary of Agriculture to determine which nominees will be appointed as new board members.

Finally, each of the NMB programs attends mango industry events throughout the supply chain, starting on the production side and moving through every stage of the industry all the way to end users. NMB participates in produce industry events, and meetings with other commodity boards and with the USDA as necessary.

## U.S. Mango Market

### Mango Varieties Available in the U.S.

Mangos originated in Southeast Asia and India over 4,000 years ago. Their cultivation has since spread to other tropical and subtropical regions of the world (Campbell, et al., 2002). There are over a thousand mango varieties around the world, but only six varieties are commonly available year round in the United States: ‘Tommy Atkins’ (37%); ‘Kent’ (27.7%); ‘Ataulfo’ (19%); ‘Keitt’ (11.1%); ‘Haden’ (2.9%) and ‘Francis’ (1.8%) (Fig. 1). In addition, the following varieties have been reported in the U.S. marketplace in recent years: ‘Alphonso’, ‘Angie’, ‘Banilejo’, ‘Calypso’, ‘Edwards’, ‘Glenn’, ‘Julie’, ‘Kensington’, ‘Kesar’, ‘Mallika’, ‘Manila’, ‘Mingolo’, ‘Nam Doc Mai’, ‘Palmer’, ‘R2E2’, ‘Rapoza’ and ‘Smith’ among others.

### Mango Supply to the U.S. Market

Due to the potential risk of introducing non-native pests that could affect domestic agriculture, all mangoes produced outside

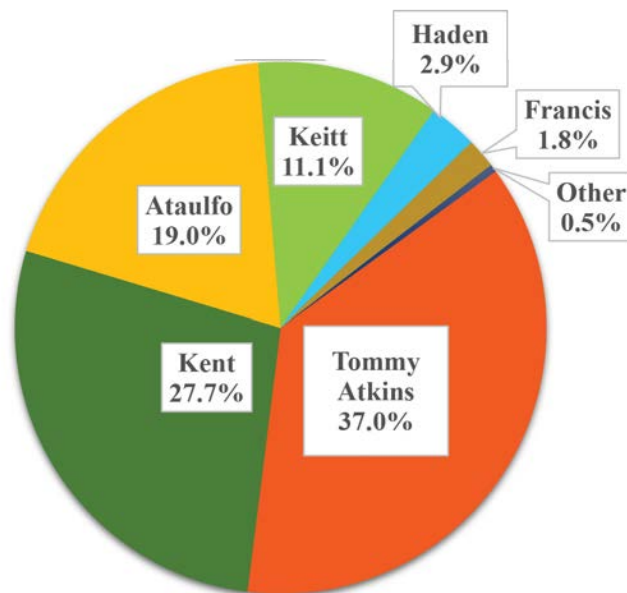


Fig. 1. Mango variety availability in the United States market. Source: USDA Market News and National Mango Board.

the United States mainland must have authorized import permits and comply with phytosanitary treatment protocols that have been reviewed and approved by USDA Animal Plant Health & Inspection Service (APHIS, 2018). These protocols are established are specific for each country or producing region. They currently include the following treatment methods: hot-water, irradiation, high temperature forced air, vapor heat, or the fruit is produced in a designated and recognized fruit fly-free area (APHIS, n.d.). As of 2021, 19 countries have APHIS-approved phytosanitary treatment protocols in place: Australia, Brazil, Chile, Costa Rica, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, India, Jamaica, Mexico, Nicaragua, Pakistan, Peru, Taiwan, Thailand, Venezuela, and Vietnam.

Nearly all mangoes supplied to the US market are from Latin American countries, accounting for ~97% of mango imports in 2020. Some domestic production exists in southern Florida, southern California, and Hawaii, but is mostly consumed by the local market or sold online. Puerto Rico also has commercial mango production, but it is mostly exported to the European market or consumed locally.

In 2020, most of the mangoes in the US market were supplied by Mexico (63%), Peru (14%), Ecuador (10%), Brazil (9%), Guatemala (2%), and Haiti (1.5%). (Fig. 2). Other countries exporting to the United States in recent years include the Dominican Republic, Costa Rica, Nicaragua, Jamaica, Australia, Thailand, India, and Pakistan.

### 2020 U.S. Import Data on Mango

In 2020, the total volume of mango imported into the US was 549,225 MT (FAS, n.d.). The standard container used by the mango industry is a 4-kg box. The 2020 import volume is roughly 137.3 million boxes, an increase of 11.4% compared to the previous year. From 2005 to 2020, the mango import volume into the U.S. increased by 110% (Fig. 3).

The 2020 volume from the five main exporting countries (Mexico, Peru, Ecuador, Brazil, and Guatemala) was 132.2 million boxes, which generated U.S. \$661 million FOB as measured at ports of entry. This represented an increase of 4.1% compared

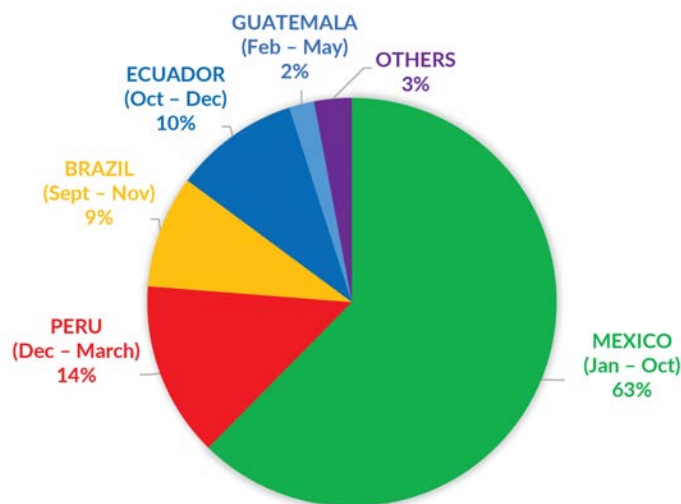


Fig. 2. Mango volume import percentage by country and months of export. Source: USDA Market News and National Mango Board.

to 2019. Since 2005, the increase in whole mango FOB has been 152% (Fig. 3). The average price per box of mangoes during 2020 was U.S. \$5.00, a decrease of 6.0% compared to \$5.32/box in 2019 (NMB, 2020a).

### U.S. Retail Data on Mango

Since 2007, the NMB working with the Nielsen Group's *Answers on Demand* (AOD), has been collecting and analyzing mango category retail sales data to provide a resource that maintains a historical reference and performance benchmarks to help retailers and mango industry members identify trends and opportunities in mango sales growth. The mango category performance benchmark in this report summarizes 2020 data for whole and fresh-cut mangos, including sales, volume, and pricing.

Mango category sales data are from U.S. grocery store chains with more than \$2 million in annual sales from roughly 18,000

stores. It is collected on a weekly basis by store and by item and represents fruit items sold in the produce department. Small independent chains and alternative format retailers such as Whole Foods and Trader Joe's are included in the data. Volume is measured by unit (1 whole mango = 1 unit), for those retailers who sell mangos by the pound, a conversion rate is applied. Price is in U.S. dollars (\$) per mango unit; per store sales are also in U.S. dollars (\$). A more detailed and descriptive analysis of mango performance (volume, price and sales) per store per week, per region, per quarter, and yearly is available through the NMB.

### US Retail Whole Mango Results

Whole mango dollars per store/week increased from \$220 to \$262 in 2020, an increase of 19%. (Fig. 4). This 12% growth was a result of an increase in mango volume per store/week from 233 to 261 units. The average retail price per mango increased by 6% from \$0.95 to \$1.01. (Figs. 5 and 6). Whole mango dollars per store/week increased in every quarter in 2020, while volume per store/week increased in every quarter except Q2, a result of the onset of the COVID-19 pandemic.

In 2020, the average retail price per unit per month dropped to \$0.85/unit in July, and peaked at \$1.28/unit in October. For 2020 overall fruit rankings at the retail level, whole mango advanced one spot to twelfth position in volume per store/week (Fig. 5) and moved up three spots from the prior year to seventeenth overall for dollars per store/week. (Fig. 4).

### U.S. Retail Fresh-Cut Mango Results

Fresh-cut mango retail performance is separated into two categories, "Mango Only" which is consumer packages that only contain fresh-cut mango, and "Mango Mix" which includes fresh-cut mango mixed with other fruits within the same package. Fresh-cut Mango Only dollars per store/week increased from \$100 to \$106 in 2020, an increase of 6%. While fresh-cut Mango Mix dollars per store/week decreased from \$108 to \$79, a decrease of 27%. (Fig. 7).

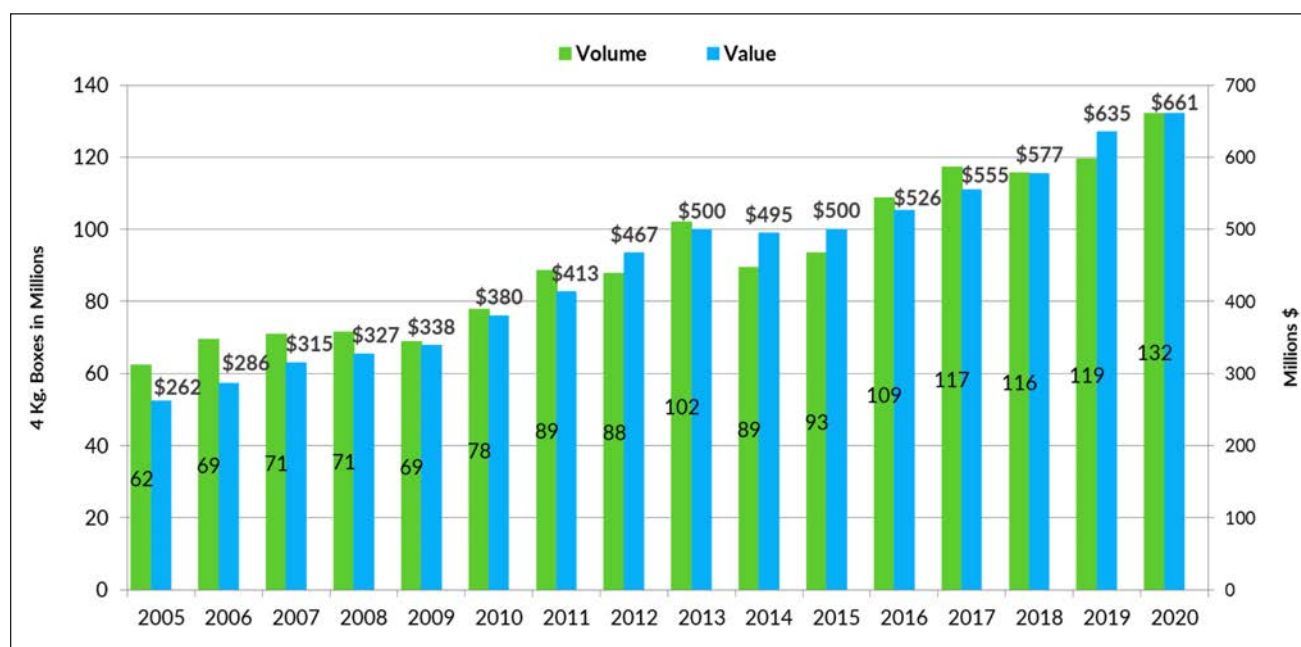


Fig. 3. Total Mango Import Volume & Value, for Five Main Exporting Countries (Mexico, Peru, Ecuador, Brazil, and Guatemala). Source: USDA Market News and National Mango Board.

FRUITS	Ranking	Dollars/Store/Week	% Change Year Over Year
<b>All Fruits</b>		<b>\$14,851</b>	<b>8.1%</b>
Apples	1	\$2,202	3.8%
Grapes	2	\$1,928	0.2%
Bananas	3	\$1,894	4.4%
Strawberries	4	\$1,866	16.0%
Avocados	5	\$1,618	7.7%
Blueberries	6	\$1,281	11.2%
Cherries	7	\$1,268	25.6%
Mandarins/Tangerines	8	\$930	10.2%
Watermelons	9	\$753	10.6%
Oranges	10	\$746	27.5%
Raspberries	11	\$722	9.2%
Lemons	12	\$526	22.0%
Peaches	13	\$444	-1.3%
Blackberries	14	\$443	14.2%
Limes	15	\$442	24.5%
Pears	16	\$273	-1.6%
<b>Mangos</b>	<b>17</b>	<b>\$262</b>	<b>19.4%</b>
Nectarines	18	\$255	1.3%
Pineapples	19	\$242	14.5%
Cantaloupe Melons	20	\$230	3.3%
Plums	21	\$177	8.5%
Dipped Fruit	22	\$170	15.3%
Grapefruits	23	\$144	15.9%

Fig. 4. 2020 Average Retail Value per Store/Week. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC.

FRUITS	Ranking	Volume/Store/Week	% Change Year Over Year
<b>All Fruits</b>		<b>9,505</b>	<b>6.6%</b>
Bananas	1	3,368	4.7%
Avocados	2	1,262	16.7%
Apples	3	980	1.7%
Limes	4	951	23.0%
Grapes	5	855	1.7%
Strawberries	6	567	13.2%
Lemons	7	541	17.7%
Oranges	8	433	10.0%
Blueberries	9	355	8.5%
Cherries	10	334	8.4%
Watermelons	11	313	-1.3%
<b>Mangos</b>	<b>12</b>	<b>261</b>	<b>11.9%</b>
Peaches	13	228	-7.2%
Raspberries	14	227	17.2%
Mandarins/Tangerines	15	212	11.6%
Blackberries	16	149	13.5%
Pears	17	149	-7.8%
Cantaloupe Melons	18	127	-4.6%
Pineapples	19	118	15.4%
Nectarines	20	116	-4.3%
Papayas	21	115	1.8%
Kiwis	22	95	3.3%
Grapefruits	23	81	11.2%

Fig. 5. 2020 Average retail volume per store/week. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC.

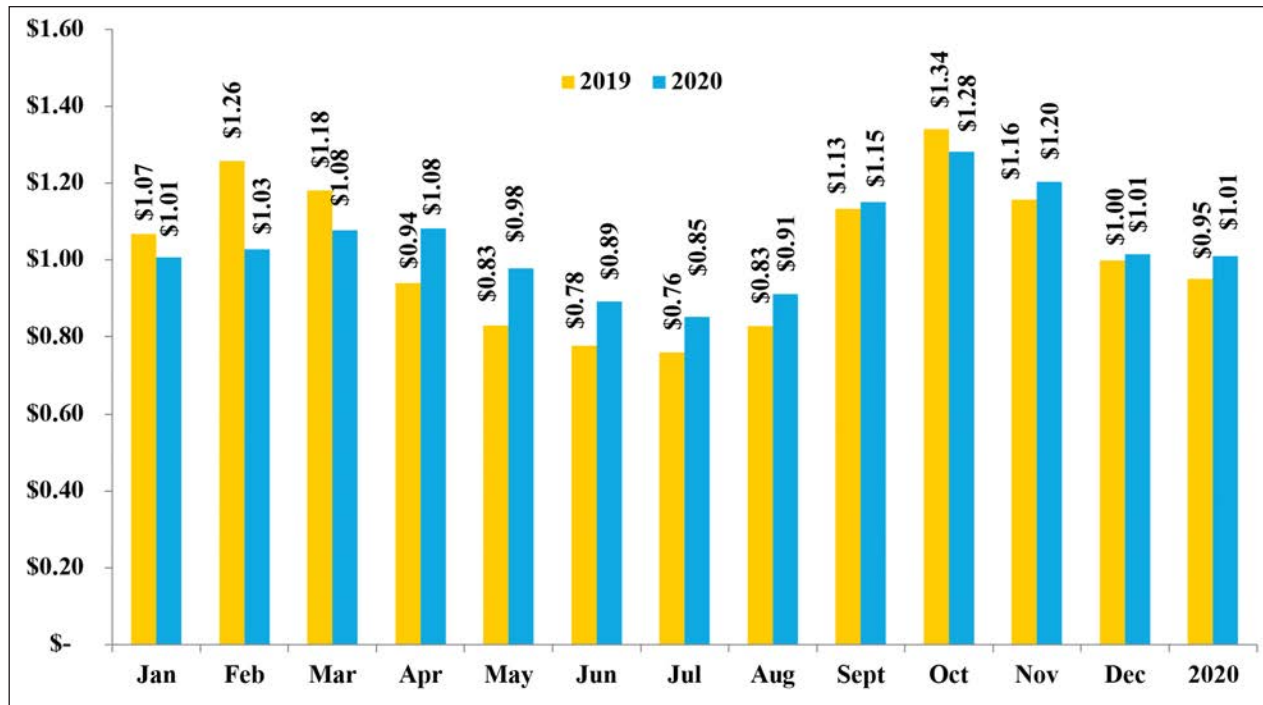


Fig. 6. 2020 Average monthly price of mango at retail. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC

At \$95,641,078, total fresh-cut Mango Only sales were up by 7.9%, while at \$40,810,723, total fresh-cut Mango Mix sales were down 4.6% in 2020. (Fig. 8). Total sales of fresh-cut mango increased in every month of 2020, except for February and April.

Fresh-cut mango sales per store/week peaked in August at \$124, but dipped to \$89 in December (Fig. 9). For 2020 fresh-cut fruit rankings, Mango Only ranked seventh and Mango Mix was ranked twelfth (NMB 2020b).

	Rank	Dollars/ store/week	% Change YOY	Dollar contribution to total fruit cut	% Change YOY
<b>Fresh cut fruit</b>		<b>\$1,553</b>	<b>0.1%</b>	<b>100%</b>	--
Watermelon	1	\$ 557	9.8%	27.2%	2.8%
Mixed fruit	2	\$ 394	-9.8%	20.7%	-2.6%
Pineapple	3	\$ 299	2.3%	15.9%	0.6%
Cantaloupe	4	\$ 168	2.8%	7.4%	0.3%
Specialty melons	5	\$ 168	-1.0%	2.8%	0.2%
Remaining berries	6	\$ 150	5.1%	0.2%	0.0%
Remaining fruit	7	\$ 148	-29.5%	1.4%	-0.8%
Fruit cocktail	8	\$ 121	-34.0%	0.0%	0.0%
Fruit salad	9	\$ 120	-12.5%	4.1%	-0.2%
Mixed berries	10	\$ 113	-3.8%	3.0%	-0.2%
Apples	11	\$ 108	-15.4%	4.3%	-1.0%
<b>Mango only</b>	<b>12</b>	<b>\$ 106</b>	<b>6.0%</b>	<b>3.6%</b>	<b>0.3%</b>
Strawberries	13	\$ 89	-1.8%	1.7%	0.1%
<b>Mango mix</b>	<b>14</b>	<b>\$ 79</b>	<b>-27.0%</b>	<b>1.5%</b>	<b>-0.1%</b>
Tangerines	15	\$ 66	13.8%	0.1%	0.0%

Fig. 7. 2020 Average fresh-cut mango dollars per store/week. YOY = year over year. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC.

	Rank	Dollars	% Change vs. YAGO	Dollar contribution to total fruit cut	% Change vs. YAGO
<b>Fresh cut fruit</b>		<b>\$2,659,014,773</b>	<b>-1.2%</b>	--	--
Watermelon	1	\$723,524,137	10.3%	27.2%	2.8%
Mixed fruit	2	\$549,659,312	-12.3%	20.7%	-2.6%
Pineapple	3	\$423,090,439	2.5%	15.9%	0.6%
Cantaloupe	4	\$197,765,747	2.5%	7.4%	0.3%
Apples	5	\$113,763,783	-19.8%	4.3%	-1.0%
Fruit salad	6	\$109,711,637	-6.1%	4.1%	-0.2%
<b>Mango only</b>	<b>7</b>	<b>\$95,641,078</b>	<b>7.9%</b>	<b>3.6%</b>	<b>0.3%</b>
Mixed berries	8	\$79,500,475	-8.1%	3.0%	-0.2%
Grapefruit	9	\$78,053,693	27.5%	2.9%	0.7%
Specialty melons	10	\$74,928,279	6.6%	2.8%	0.2%
Strawberries	11	\$43,904,131	6.8%	1.7%	0.1%
<b>Mango mix</b>	<b>12</b>	<b>\$40,810,723</b>	<b>-4.6%</b>	<b>1.5%</b>	<b>-0.1%</b>
Remaining fruit	13	\$36,128,572	-37.5%	1.4%	-0.8%
Pomegranate	14	\$31,727,380	-2.1%	1.2%	0.0%
Honeydew	15	\$29,916,420	-6.8%	1.1%	-0.1%

Fig. 8. 2020 Fresh-cut mango total dollars & contribution. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC.

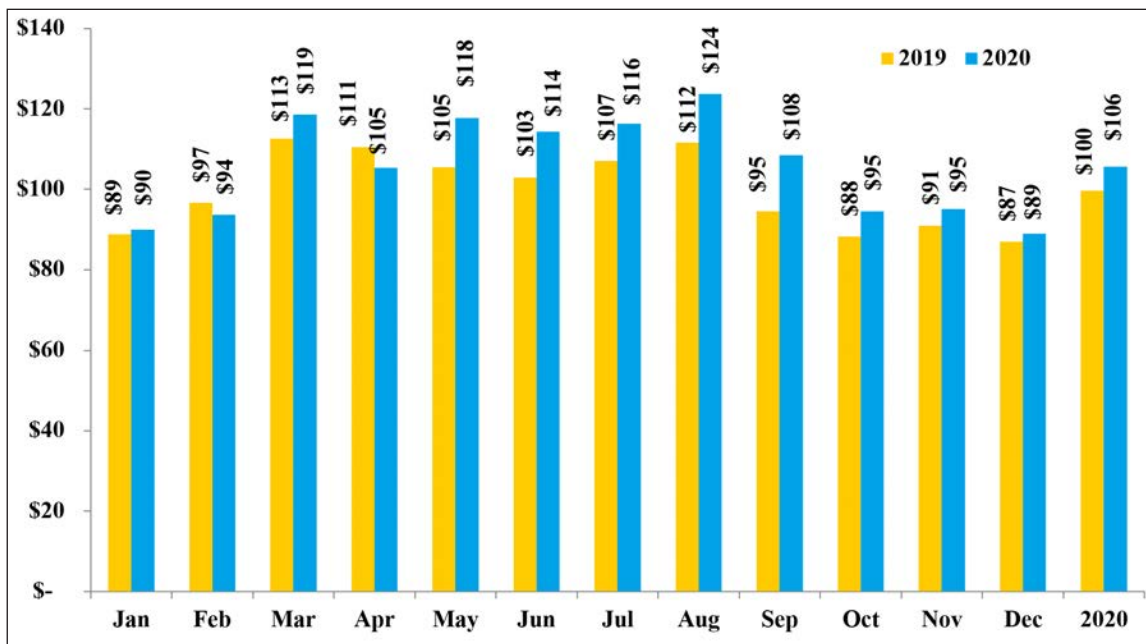


Fig. 9. 2020 Average fresh-cut mango monthly dollars per store/week. Source: Nielsen Answers on Demand® (week 52 ended 12/26/2020) Total US × AOC.

### U.S. Per Capita Consumption of Mango

Per capita consumption of mango in the US has been growing over the last fifteen years from 1.88 pounds in 2005 to an all-time high of 3.63 pounds in 2020, an increase of 193%. (Fig. 10).

In 2005 mango was ranked seventeenth in per capita fruit consumption, but may have moved up to twelfth place in 2020. Over the past fifteen years, per capita mango consumption has surpassed pears, peaches, honeydew melons, and grapefruit consumption. (Fig. 11).

### \*\*NMB Impact on Mango Demand and Return on Investment

Pursuant to the Mango Order, the NMB is required to conduct an independent evaluation on the effectiveness of its programs every five years. These reports are submitted to USDA and made available to the public. The purpose of the independent evaluation is to evaluate the impact of NMB programs on enhancing the U.S. demand for mangos. The NMB uses an extensive household for

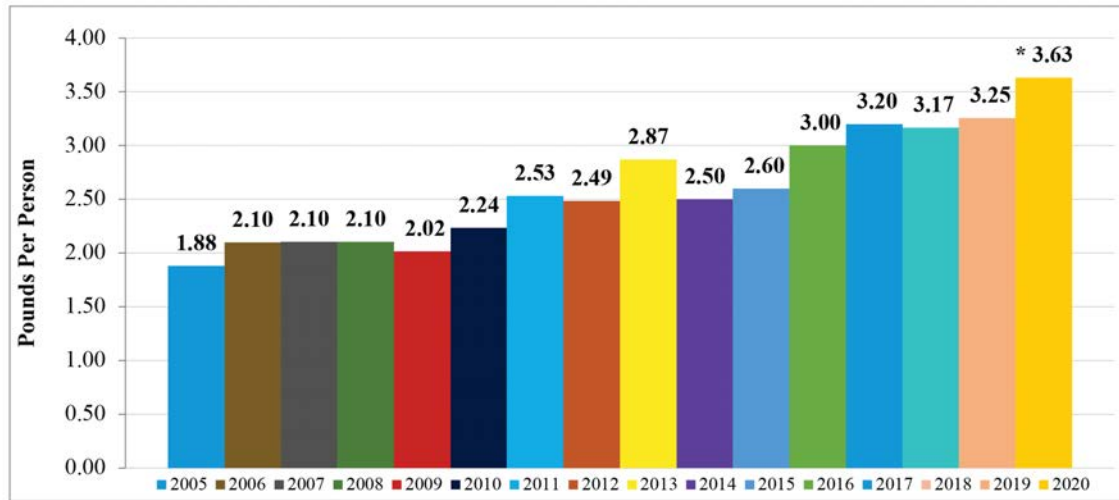


Fig. 10. U.S. per capita consumption of fresh whole mango. Source: USDA Economic Research Service. \*2020 Per Capita Consumption calculated by the NMB.

FRUITS	2005 Ranking Per Capita Consumption	2005 Per Capita Consumption in lbs.	2018 Ranking Per Capita Consumption	2018 Per Capita Consumption in lbs.	2020 Per Capita Consumption in lbs.
Bananas	1	25.2	1	28.3	
Apples	2	16.8	2	17.0	
Watermelons	3	13.5	3	15.7	
Oranges	4	11.4	4	8.2	
Grapes	6	8.7	5	8.1	
Avocados	10	3.5	6	8.1	
Pineapples	8	4.9	7	7.8	
Strawberries	7	5.8	8	7.1	
Cantaloupe Melons	5	9.6	9	7.0	
Mandarins/Tangerines	14	2.5	10	5.4	
Lemons	11	2.9	11	4.1	
Limes	15	2.0	12	3.5	
Mangos	17	1.88	13	3.17	3.63*
Pears	12	2.9	14	2.9	
Peaches	9	4.8	15	2.2	
Blueberries	21	0.4	16	2.0	
Honeydew Melons	16	1.9	17	2.0	
Grapefruits	13	2.6	18	1.6	
Papayas	18	0.9	19	1.3	
Cherries	19	0.9	20	1.3	
Raspberries	23	0.1	21	0.8	
Kiwis	20	0.5	22	0.6	
Apricots	22	0.1	23	0.1	

Fig. 11. U.S. fresh fruit per capita consumption. Source: USDA Economic Research Service. \*2020 Per Capita Consumption calculated by the NMB.

econometric demand models to show the probability of a consumer buying mangos and the number of mangos purchased. The success of NMB programs is measured based on each household's awareness of mango promotions. Both household awareness and NMB expenditure measures have had a statistically positive impact on U.S. mango demand.

For the five-year evaluation conducted in 2021, Dr. Ronald Ward, Emeritus Professor of Economics at the University of Florida, analyzed household surveys collected between March 2013 and December 2020. Approximately 1,000 household surveys are conducted each month. Care is taken to ensure the data are representative of the U.S. population. As of June 2021, the cumulative database includes nearly 170,000 entries dating back to 2008, but since household awareness questions only started in

2013, the models in the 2021 independent evaluation only cover the period from 2013 to 2020.

### Market Penetration, Market Intensity and Retail Mango Sales

Applying the household awareness model, both market penetration and market intensity were estimated with NMB programs in place and then assuming they did not exist. During the period of March 2013 to December 2020, both market penetration and market intensity increased with a portion of the growth attributed to NMB programs. Average market penetration with NMB promotions in place was 14.33% of households purchasing mangos during a two-week shopping period, compared to 13.55% without NMB promotions; this represents an increase of 0.78% for



Table 2. Results of the 2021 mango promotion awareness model.

Mango promotion Awareness model	Promotion awareness	Base 2013 Mar. to 2015 Dec.	2016 Jan.–Dec.	2017 Jan.–Dec.	2018 Jan.–Dec.	2019 Jan.–Dec.	2020 Jan.–Dec.
Market penetration	Yes	0.073	0.134	0.154	0.136	0.164	0.199
	No	0.069	0.125	0.146	0.129	0.155	0.189
Market intensity	Yes	3.224	3.960	3.608	3.389	3.636	3.635
	No	3.056	3.656	3.398	3.211	3.407	3.402
Average retail price (\$ per retail mango)		\$1.19	\$1.34	\$1.37	\$1.28	\$1.36	\$1.38
----- millions -----							
Household mangos	Yes	2199	1773	1880	1523	1993	2426
	No	1970	1530	1673	1735	1762	2160
Implied increase in mango demand		229	243	208	148	231	266
Household expenditures	Yes	\$2,559.72	\$2,380.71	\$2,571.83	\$1,930.86	\$2,708.60	\$3,330.71
	No	\$2,294.43	\$2,048.82	\$2,287.01	\$1,743.07	\$2,396.92	\$2,926.95
Gains		\$265.29	\$331.89	\$284.82	\$187.78	\$311.69	\$367.75
FOB equivalent (34.07% margin)	Yes	\$872.10	\$811.11	\$876.22	\$657.84	\$922.82	\$1,134.77
	No	\$781.71	\$698.03	\$779.18	\$593.87	\$816.63	\$1,009.48
FOB \$ Difference		\$90.38	\$113.07	\$97.04	\$63.98	\$106.19	\$125.29
NMB expenditures		\$17.57	\$6.59	\$6.12	\$6.87	\$7.90	\$6.63
<b>Implied ROI (starting with March 2013)</b>		<b>5.14</b>	<b>17.17</b>	<b>15.86</b>	<b>9.31</b>	<b>13.45</b>	<b>18.90</b>

Table 2. Estimated return on investment (ROI) of NMB awareness programs.

Rows	NMB Awareness Model (March 2013 to Dec. 2020)	With NMB (U.S. \$ millions)	Without NMB (U.S. \$ millions)	Difference (U.S. \$ millions)
1	Household Mango Expenditures	\$15,482.43	\$13,733.20	\$1,749.23
2	Retail/F.O.B. Factor	0.3407	0.3407	—
3	\$ Sales at F.O.B.	\$5,274.86	\$4,678.90	\$595.95
4	NMB Expenditures	\$51.68	\$0.00	\$51.68
5	ROI = (Row 3 / Row 4)	—	—	\$11.53

market penetration. Average market intensity was 3.575 mangos per purchase with NMB promotions in place, compared to 3.355 mangos per purchase without NMB promotions; an increase of 6.56%. (Table 1).

Using the studies above to the empirical models, it is possible to estimate the household mango expenditures directly attributable to NMB programs. Fig. 12 shows household mango expenditures with and without the NMB programs. The difference in demand times the average retail price is attributed to NMB mango promotion programs. During the 94-month period from March 2013 to December 2020, estimated household mango expenditures measured at FOB totaled U.S. \$5,274 million with the NMB programs in place and U.S. \$4,678 million without them, a difference of U.S. \$595 million. This represents an increase of 12.7% in FOB U.S. mango sales attributable directly to NMB programs.

### Return on Investment

The return on investment (ROI), a.k.a. the “Benefit Cost Ratio”, is a common formula used to measure the performance, of an investment. For commodity boards, such as the NMB, the ROI measures how much additional value has been created from the generic promotion programs relative to program expenditures. Using the analysis developed for measuring mango demand, it is possible to measure the ROI that the NMB promotion programs have generated for the mango industry (Ward, 2021).

Table 2 shows the differences between household mango purchases at retail from March 2013 to December 2020 with

and without NMB programs and expenditures. Since the NMB assessments are collected at the port-of-entry or FOB level, retail sales must be expressed at the same level. NMB research has determined that an adjustment factor of 0.3407 between the FOB and retail price is accurate. Using this adjustment factor allows the retail value to be expressed at the FOB level. The bottom line is that, for each dollar the mango industry has invested in NMB programs, an addition \$11.51 was generated in FOB sales.

### Literature Cited

- Campbell, R. N. Ledesma, and C. Campbell, 2002. Tropical Mangos: How to grow the world’s most delicious fruit. Fairchild Tropical Garden., Miami, FL.
- National Mango Board (NMB). 2021. Financial Statements and Supplementary Information Years Ended December 31, 2020 and 2019. <<https://www.mango.org/wp-content/uploads/2021/03/National-Mango-Board-2020-fst-1231-EV-Final-SECURED-4.pdf>>
- National Mango Board. N.D. Mango Varieties and Availability. <[www.mango.org/mango-varieties-availability/](http://www.mango.org/mango-varieties-availability/)>
- National Mango Board. 2020a. Import Volume, Value and Price for Top 5 Countries. <[https://www.mango.org/wp-content/uploads/2021/09/2020-Mango-Crop-Report-Volumes-Value-Price-by-Country-and-Total\\_03.10.21\\_LO.pdf](https://www.mango.org/wp-content/uploads/2021/09/2020-Mango-Crop-Report-Volumes-Value-Price-by-Country-and-Total_03.10.21_LO.pdf)>
- National Mango Board. 2020b. Mango Category Performance Report. <<https://www.mango.org/wp-content/uploads/2021/03/2020-Mango-Category-Development-Report.pdf>>
- United States Code of Federal Regulations (CFR). 2004. Part 1206—

Mango Promotion, Research, and Information Order. 7 CFR 1206.42. [69 FR 59122, Oct. 4, 2004; as amended (*1206.30, 1206.31 and 1206.32*) at 76 FR 36283, June 22, 2011; as amended (*1206.31*) at 78 FR 39566, July 2, 2013; (*1206.42*) at 68 FR 58554, Oct. 9, 2003, amended 77 FR 21846, Apr. 12, 2012].

USDA Agricultural Marketing Service (AMS). Commodity Promotion, Research, and Information Act of 1996. 1996. <<https://www.govinfo.gov/content/pkg/USCODE-1996-title7/pdf/USCODE-1996-title7-chap101-subchapII.pdf>>

USDA Animal & Plant Health Inspection Service (APHIS), Quarantine 56. 2018 Regulations pertaining to the importation of fruits and vegetables <[https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/q56/ct\\_quarantine\\_56](https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/q56/ct_quarantine_56)>

USDA Animal & Plant Health Inspection Service (APHIS), Fruits and Vegetables Import Requirements (FAVIR): Mango. N.D. <[https://epermits.aphis.usda.gov/manual/index.cfm?action=commSummCountryP&COMMOD\\_ID=79&dspNavBar=1](https://epermits.aphis.usda.gov/manual/index.cfm?action=commSummCountryP&COMMOD_ID=79&dspNavBar=1)>

USDA Foreign Agricultural Services (FAS). n.d. Global Agricultural Trade System Online (GATS Online), <<https://apps.fas.usda.gov/gats/default.aspx>>

USDA Economic Research Service (ERS), Food Availability (Per Capita) Data System <<https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/>>

Ward, R.W. 2021. Generic Promotion of Mangoes and Its Impact on the U.S. Demand for Mangos. An Evaluation of the National Mango Board.

